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THE EFFECT OF DEPLOYMENT ON CHOLESTEROL LEVELS OF ACTIVE DUTY PERSONNEL

by

Renae R Denelsbeck
Bachelor of Science in Nursing, Excelsior College, 2002

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This thesis, submitted by Renae R. Denelsbeck in partial fulfillment of the requirements for the Degree of Master of Science from the University of North Dakota, has been read by the Faculty Advisory Committee under whom the work has been done and is hereby approved.

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This thesis meets the standards for appearance, conforms to the style and format requirements of the Graduate School of the University of North Dakota, and is hereby approved.

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ABSTRACT

With the present environment of worldly unrest, the military presence in foreign countries can be expected to continue for quite some time. The current deployment rates for many active duty personnel average well over 200+ days per year. The standard practice for the installation being studied is to deploy for 30, 60, 90, or 120 day rotations.

Each military member is required to have a complete physical annually, including cholesterol screening beginning at age 25, or younger upon request. The annual physical is usually coordinated with the member's birth month, but is to be completed as soon as possible after the member's return from deployment, if they were gone during that time. One might expect with the young (majority being between 18 – 40 years), healthy population in question to see fairly good results regarding cholesterol levels. It was noted that several members returned from deployment with elevated levels, sometimes to the degree of being grounded from flying until being put on medication to lower their cholesterol.

The purpose of this study was to determine the prevalence of elevated levels pre-deployment and post-deployment in order to determine the extent of the problem or if it exists at all. A review will be conducted of the 400+ medical records of special duty personnel enrolled to a particular military installation.

Members were included in the study if they had completed a lipid panel within 12 months prior to deployment and within 30 days of returning from deployment, thus

making deployment criteria for participating as well. All records meeting the above requirement of male, cholesterol levels recorded maximum of 12 months prior to deployment, deployment period of 30 days or greater, and a post-deployment cholesterol within 30 days of return were eligible to be included in the study.

By determining the elevated prevalence of cholesterol levels among returning deployed military members, one can begin the process of evaluating the many variables that may affect cholesterol levels. From the standpoint of nursing, the knowledge is well documented that morbidity and illness resulting from cardiac related diseases is reduced with patient education and aggressive management to motivate patients to become more active and change lifestyle habits.

While not statistically significant in findings of this study, there are clinical significant components to consider. When evaluated individually, averages were slightly higher for LDL's and total cholesterol levels, while HDL's were seen to have dropped in some cases. Further study is needed to determine how often this happens and more importantly, why this is happening to our deployed military members.

This study could perhaps be a stepping stone to revamp how our active duty personnel live in deployed locations, what services we offer them in both deployed and home locations, and the health care in addition to the costs associated with the health care required for these members at some future date, as career military members are given the benefit of lifetime medical care.

Disclaimer: The views expressed in this thesis are those of the author, and do not reflect the official policy of the United Stated Air Force, Department of Defense, or the U.S. Government.

CHAPTER 1

INTRODUCTION

The world situation of the past five years has been unsettled and unnerving. Much of the media attention has been focused on the Middle East, particularly Iraq. Beginning in August, 2002, thousands of military troops have seen deployment and the "sandbox", as it is affectionately called, firsthand. These deployments bring about new circumstances for many of these young soldiers, circumstances of family separation, anxiety, and facing one's own mortality. Other circumstances of the high deployment rate may not be known until some point in the future.

Few actual studies on active duty military exist in regards to cholesterol levels and deployment related activities. Some research has been done on stress levels, mental health, and post-traumatic stress syndrome. Other research has been done on the "Gulf War Syndrome" and various symptoms of veterans from that conflict. But very little to date explicitly in relation to cholesterol levels and the deployed lifestyle, particularly nutritional intake, activity levels, and elevated stress levels on a long-term basis. One very well known study (not militarily related) has made great strides with researching cholesterol levels, heart disease, and particular lifestyle habits.

Background

For 50 years, the Framingham Heart Study and the residents of Framingham, Massachusetts, have been synonymous with the remarkable advances made in the

prevention of heart disease in the United States and throughout the world (www.Framingham.com). Before Framingham, most physicians believed that atherosclerosis was an inevitable part of the aging process and were taught that blood pressure was supposed to increase with age, enabling the heart to pump blood through an elderly person's narrowed arteries. The study established a relationship between the levels of cholesterol and risk for disease, along with a positive association with a lifestyle typified by a faulty diet, sedentary living, and/or unrestrained weight gain and elevated cholesterol levels. Study after study validate similar findings, that reduced cardiovascular risks are directly linked to lifestyle changes such as diet, weight loss, exercise and smoking cessation (Heilbronn & Clifton, 2002), (www.nfb.org), (Turkoski, 2004).

A question one might ask is was there a relationship at the time the Framingham study was done as well? In the late 1940's, our soldiers were returning from war similar to today's situation. If a comparison had been made at that time, would a link have been made between the deployment to war, the elements of deployment and elevated cholesterol levels? The Framingham Study came about in relation to a mounting epidemic of cardiovascular disease that began in the 1930's. Will we see another epidemic of increases in cardiovascular symptoms and disease in relation to our military population?

Purpose Statement

The purpose of this research study is to determine how cholesterol levels are affected by deployment and to identify if a relationship between negatively affected cholesterol levels and deployment exists.

Significance

For more than a century, coronary heart disease has been the number 1 cause of death in the United States (American Heart Association, americanheart.org. 2004). Cardiovascular disease is also one of the main causes of death in Western Europe (Kanstrup, Refsgaard, Engberg, Lassen, Larsen, & Lauritzen, 2002). This silent killer is known to be related to elevated plasma cholesterol, smoking, hypertension and obesity, all factors that individuals have some control over. Yet, one-third of the adult U.S. population is considered obese, millions worldwide choose to smoke, and the majority of people fail to take simple steps to reduce these risks. The United States active duty military population is not exempt from cardiovascular heart disease or the risk factors associated with it.

Stress also plays a part in the big picture of coronary disease. Although stress is not considered a traditional risk factor, some researchers have noted a relationship between cardiovascular disease risk and stress in a person's life, their health behaviors, and socioeconomic status (Karlovic, Martinac, Buljan, & Zoricic, 2004), (Hoge, Castro, Messer, McGurk, Cotting, & Koffman, 2004), (Cawkill, 2004). Direct correlation has been made between increased concentrations of cholesterol, triglycerides, and LDL-C in soldiers with post-traumatic stress syndrome (Karlovic, et al, 2004). A look at the deployment rate of military units clearly indicates increased levels of stress.

Literature Review

Very few studies on deployment of active duty military members are readily available. Whether this is because few studies have actually been done or what studies have been done resulted in insignificant information or information that became

classified is unknown. Most studies concentrate on the mental health aspect of deployment and active duty, such as post-traumatic stress disorder. One such study published in the New England Journal of Medicine concentrated solely on combat duty in Iraq and Afghanistan (Hoge, et.al). Criteria for inclusion were the self-reported evaluation of combat exposure and post-traumatic stress disorder symptoms and the mental health status of these individuals.

One study, the Air Force/ Texas Coronary Atherosclerosis Prevention Study (AFCAPS/ TexCAPS), was done as a randomized, double-blind, placebo-controlled primary prevention trial. There were no criteria to rule out being active duty, nor was there a prerequisite to be active duty military. However, the Air Force was involved in the study so deduction would have it that military were not excluded. It was designed to test the hypothesis that in addition to a lipid-lowering diet, treatment with lovastatin is more effective than placebo in reducing acute major coronary events in a cohort with normal to mildly elevated total and LDL cholesterol and low HDL cholesterol (Downs, John R., Beere, Polly A., Whitney, Edwin, Clearfield, Michael, Weis, Stephen, Rochen, Jeffrey, Stein, Evan A., Shapiro, Deborah R., Langendorfer, Alexandra, & Gotto Jr., Antonia M.).

Stress has been evaluated time and time again with various aspects of health and medical conditions (Michel, Lundin, & Larsson,, 2003), (Smoak, Norton, Ferguson, & Deuster, 1990), (Cawkill, 2004). Cawkill's study on the understanding and attitudes of stress-related problems indicated belief by the active duty members that seeking help with these type of problems would result in negative repercussions. It was also noted that

little support from peers or commanders was available nor was there any notable training available during the recruit phase of training.

On the other hand, thousands of studies exist relating risk factors, disease states, nutritional habits, and sedentary lifestyle leading to coronary heart disease (Hunninghake, Stein, Dujovne, Harris, Feldman, Miller, Tobert, Laskarzewski, Quiter, Held, Taylor, Hopper, Leaonard, & Brewer, 1993), (Weber, 2002), (Tosiello, Reddy, Mora, Redberg, Sharrett, & Blumenthal, 2004). Meanwhile, again, specific studies of coronary heart disease affecting active duty military members is sparse. When considering the average age of active duty members (23 - 27 years of age), one would not expect to find a high prevalence of CHD among this population, thus little need for study.

The only true study found to even remotely compare serum lipid concentrations and active duty service looked primarily at those diagnosed with post-traumatic stress disorder (Karlovic, et.al). The duration of combat activity was 3.5 + 0.8 years and 6.2 + 0.9 years had elapsed since they had experienced combat trauma. Although this is an important aspect to consider for research purposes, the more relevant question to our time is: how is the cholesterol level more eminently affected by deployment or combat activities.

Research Questions

This study looked at the question of incidence of elevated cholesterol pre and post-deployment.

1) What is the incidence of elevated cholesterol among military personnel prior to deployment? 2) What is the incidence of elevated cholesterol levels among active duty members returning from deployment?

Hypothesis

There is a direct correlation between elevated cholesterol levels of active duty military members and deployment.

1) Deployment plays a negative role in the management of elevated cholesterol.

2) The incidence of elevated cholesterol is higher upon return from deployment for active duty troops than prior to deployment.

Theoretical Framework

In today's world of health and medical information, the terms "wellness" and "health promotion" can be heard repeatedly, particularly when discussing chronic health conditions. With the condition at hand, elevated cholesterol levels, health promotion is key to successful management and treatment. But more importantly, health promotion is necessary for prevention as well.

The concept of health promotion has important associations in healthcare and has been an important aspect of various nursing studies. In the early 1980's, the initial version of the Health Promotion Model (HPM) first appeared in nursing literature. It was proposed by Nola Pender as a framework for integrating nursing and behavioral science perspectives on factors influencing health behaviors. Pender viewed environmental events, personal factors, and behavior as reciprocal determinants of health. The Health Care Model is an attempt to depict the multidimensional nature of persons interacting with their interpersonal and physical environments as they pursue health (Pender, Murdaugh, & Parsons, 2002). The model integrates a number of constructs from

expectancy-value theory and social cognitive theory within a nursing perspective of holistic human functioning.

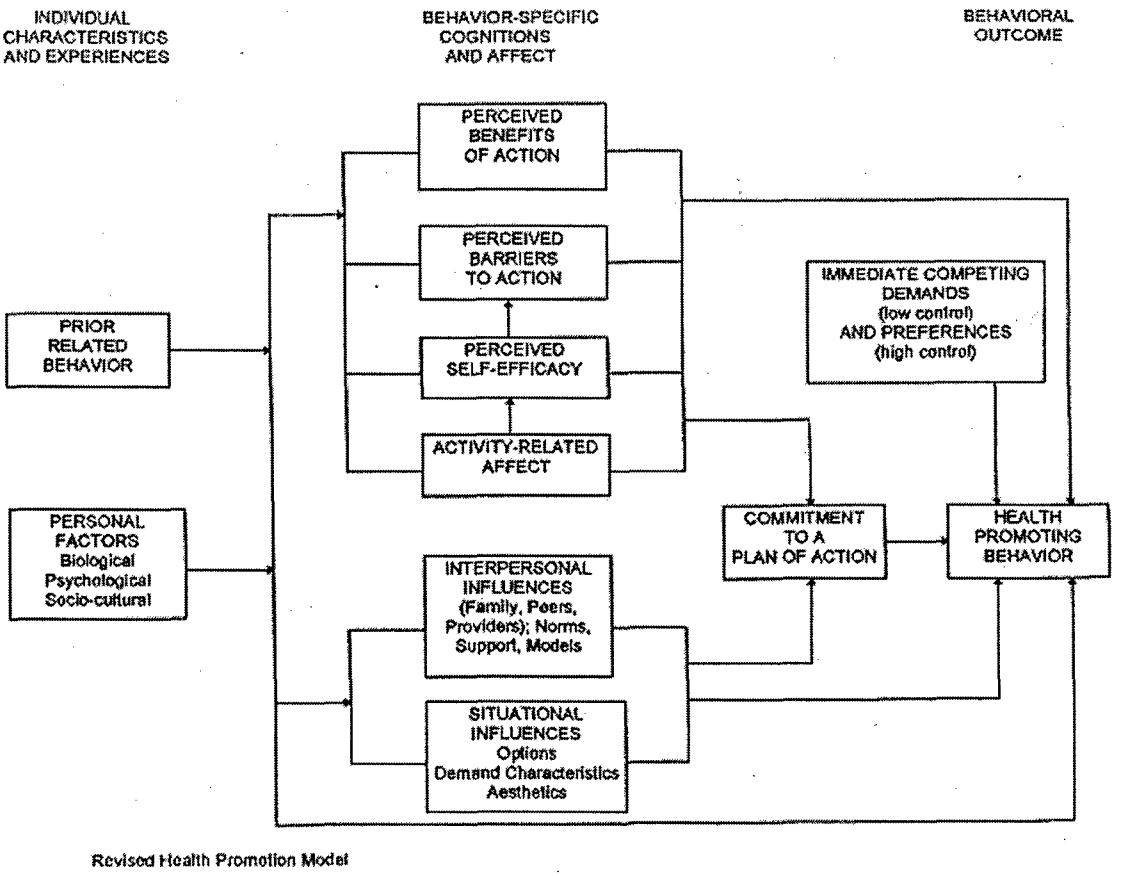

Figure 1 – Nola Pender's Health Promotion Model

Source: http://www.nursing.umich.edu/faculty/pender/chart.gif

The Health Promotion Model is based on concepts of health, health promotion, and motivation for health behavior of the person being served. Health is an evolving concept, a holistic experience, and a multidimensional approach (Young, Taylor, Renpenning, 2001). The Health Promotion Model's desired outcome is a view of health as a dynamic process inherent in the lives of individuals, families, and communities (Pender, et al, 2002). Mosby's Medical Dictionary defines health as a condition of

physical, mental, and social well-being and the absence of disease or other abnormal condition (Mosby's Medical Dictionary, Mosby Inc, 1998).

The concept health promotion can be defined as a lifelong process that focuses on optimal development of our physical, emotional, mental, and spiritual selves (Fontaine, 2000). An important aspect of health promotion is that it also encompasses the other foci of care. Even when care is directed toward alleviating or preventing illness or disability, it will still contribute to health promotion. One of the defining characteristics of health promotion is that it goes beyond the alleviation of a specific illness or risk to maximize overall health (Keegan, 2001). In other words, providing symptom relief for an illness may actually contribute to alleviating other illnesses or risks.

Motivation itself is defined as conscious or unconscious needs, interests, rewards, or other incentives that arouse, channel, or maintain a particular behavior (Mosby's Medical Dictionary, Mosby Inc, 1998). It is what drives a person to action or thought, stimulated by either external or internal drives (Saunders Manual of Nursing Care, 1997). The motivation for health behavior is a major part of the framework for the Health Promotion Model.

According to the expectancy-value model, behavior is rational and economical. A person will engage in a given action and will persist in it 1) to the extent that the outcome of taking action is of positive personal value, and 2) to the degree that based on available information taking this course of action is likely to bring the desired outcome. To that end, individuals will not invest their effort and personal resources in working toward goals that are of little or no value to them. Most individuals will neither invest their efforts in goals that are perceived as impossible to achieve. The motivational

significance of the subjective value of change is based on the supposition that the more a person is dissatisfied with his or her present situation, the greater will be the benefits associated with the positive change.

Social cognitive theory presents an inter-actional model of causation in which environmental events, personal factors, and behavior act as reciprocal determinants of each other. The theory places major emphasis on self-direction, self-regulation, and perceptions of self-efficacy. Social cognitive theory proposes that human beings have the following basic capabilities:

1. Symbolization: transforming experiences into internal models that serve as guides for future action.

2. Forethought: anticipating consequences of actions taken and predicting actions to take to achieve goal.

3. Vicarious learning: leaning through others by observation and applying it to one's own behavior.

4. Self-regulation: using internal standards to arrange environment to create incentives for action.

5. Self-reflection: thinking through one's thought process and actively modifying them.

(Pender, Murdaugh, Parsons, 2002)

Given these basic capabilities, behavior is not solely formulated by internal forces or external stimuli. By contrast, behavior is stimulated by a combination of cognitions and other personal factors and environmental factors. This dynamic interaction provides a multitude of human possibilities. The model clearly demonstrates the three major

categories: individual characteristics and experiences, behavior-specific cognitions and affect, and behavioral outcome.

Individual characteristics and experiences are unique and personal and impact subsequent action. Behavior-specific cognitions and affect are important for motivation and provide focal points for intervention. These include perceived benefits of action, perceived barriers to action, perceived self-efficiency, activity-related affect, interpersonal influences, and situational influences. Behavioral outcome is the health-promoting behavior directed toward attaining positive health outcomes. Commitment to a plan of action and immediate competing demands and preferences are two variables that influence this outcome.

Rationale

With present world situations such as they are, the operations tempo is very high, with many members being deployed to various locations 250+ days of the year. The deployment locations include locations in Europe, the Middle East, and Southeast Asia. The factors of deployment vary at each location, but elevated cholesterol levels have been noted in all deployment groups to some degree.

The military requires an annual Preventive Health Assessment for all members, particularly fliers who have an additional entitlement due them, based on their health status. One aspect of the Health Assessment is specific labs for specific ages, including cholesterol screenings beginning at age 25. Given the age of the majority of this population, one might expect relatively good results, in other words, lower cholesterol levels. However, a pattern noted was actually higher cholesterol levels than expected, especially in this young population. Also noteworthy, a small percentage of members

were being "grounded" (temporarily taken off flying status) upon return from deployment related to elevated cholesterol levels, according to clinical practice guidelines and recommendations set forth by the Department of Defense. These guidelines specify upper limits of allowed total cholesterol, in combination with LDL values and minimum required HDL values to be allowed.

Some indicators of challenge are found in the health beliefs of this population. As with any other, this age-group feels they are "invincible" and do not take many health prevention techniques seriously. Individuals being counseled have made comments such as "I'm not worried about cholesterol. My grandpa worries about that, I'll worry about it when I get old too." Real threats to life, such as explosive devices, live gun fire, and suicide bombers are a here and now reality, almost tangible in a sense. Elevated cholesterol is not something visible, nor a symptom that impacts one's daily activities until much later in life. It is difficult to show the impact of health promotion techniques if the symptoms are not a problem for the patient at the present time.

The Health Promotion Model can easily be applied to the research question at hand. The deployed members of the military are confronted with many things they cannot change, including the location, number of times, and timing, in general, of their deployments. How they view various aspects of this deployment process will ultimately play a key role in their health status. Faced with life and death situations on a daily basis can affect the long-term life habits of many individuals. On the other hand, without a tangible result the active duty member can actually grasp, behavior specific actions will most likely be for the here and now.

Nola Pender proposed a 5-dimensional classification system in 1990, which includes affect, attitudes, activity, aspirations, and accomplishments. This framework for looking at health promotion displays many of the areas of deployment that military members are faced with. Included under the main 5 classifications are: positive life patterns, meaningful work, invigorating play, self-actualization, social contributions, optimism and serenity, to name a few. Under the positive life patterns heading you find some important characteristics of deployment in question: eating a healthy diet, exercising regularly, and managing stress, all potentially affecting the cholesterol levels. Also included under this heading are adequate rest, seeking and using health information, and coping constructively.

Nursing professionals interact with patients on a more frequent basis than any others in the medical realm. By understanding the perception of health of the active duty member, nursing can continue to be an avid player in the health promotion and patient education arena in this game we call life. By having a basis from which to begin, the nursing profession can have a much larger impact on this, and prospectively other, populations.

Definitions

Incidence refers to the rate of new cases with a specified condition, determined by dividing the number of new cases over a given period of time by the number at risk of becoming a new case (Friis & Sellers, 1999). Incidence studies are used to measure the frequency of developing new cases. Longitudinal designs are needed to determine incidence because the researcher must first establish who is at risk of becoming a new case – that is who is free of the condition at the onset.

Hyperlipidemia can be defined as a condition of elevated lipid levels in the blood, characterized by an increase in both cholesterol and triglycerides and caused by the presence of chylomicrons. The accumulation of triglycerides is generally proportional to the amount of dietary fat. Dyslipidemia is a more inclusive term for describing lipid abnormalities because it also incorporates reduction of HDL.

The four components of cholesterol being examined in this study include a total cholesterol value, triglycerides, HDL (high-density lipoprotein), and LDL (low-density lipoprotein). The evaluation of these components help asses a patient for risk of cardiovascular disease and assist a clinician in determining the most positive way to treat a patient for hyperlipidemia.

Reference values being weighed in this study include total cholesterol levels > 200 mg/dl, triglyceride levels > 150 mg/dl, HDL levels < 40 mg/dl, and LDL levels > 100 mg/dl. An important aspect to note is HDL values < 40 mg/dl are considered to be a risk factor in and of it self. This component of the cholesterol chemistry is most affected by physical activity and least affected by medications given for dyslipidemic conditions.

For the purposes of this study, dyslipidemia is defined as total cholesterol > 200mg/ dL; triglycerides > 150mg/dL; LDL cholesterol > 130 mg/dL with no other risk factors, > 100 mg/dL with additional risk factors; or HDL < 40 mg/dL for men and < 50mg/ dL for women. LDL goals continued to be studied and recommendations continue to be made (Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults, 2001). Additional risk factors include smoking, age (> 45 years for males, > 55 years for females), family history of early cardiac disease/ problems, and hypertension, either treated or untreated.

Deployment is a term used by military agencies describing a tour of duty away from the "home base" or main base of assignment. Periods of time to be deployed vary as much as the actual deployment site, ranging from 30 – 120 days and beyond. National guard troops utilize the term "activation" for periods of active duty, but the concept is the same.

Assumptions

Some assumptions to be considered in the pursuit of this study are:

1. All persons have the capacity for reflective self-awareness and individual coping techniques.
2. Individuals seek to actively regulate their own behavior.
3. Individuals interact with the environment, attempting to change it over time and being changed by it over time.
4. Laboratory data as reported is accurate.

Limitations

1. Sample size may be restricted based on deployment locations/individual availability.
2. Timing of the lipid panels may not be immediately upon return from deployment, depending upon the member's scheduled leave and/or previously arranged time off.
3. Previously existing health factors may exist, but not identified prior to the study.
4. Behaviors and actions, such as alcohol intake, of members may have adverse effects on cholesterol levels that are not reported or factored into the study.
5. Laboratory technique may be flawed thereby jeopardizing the validity of lab values.

CHAPTER 2

METHODOLOGY OF STUDY

Population/Sample

The population being examined is primarily 18-45 year old male active duty Air Force personnel who have been deployed 45 days or longer within the past 12 months. The non-probability method of sampling known as convenience sampling of the personnel enrolled to the flight medicine clinic of a specified Air Force base was utilized for this study. All members who have had a cholesterol panel within a specific time period (in past 12 months, for example) were included. Participants were male based on not having equal numbers of female vs. male and other extenuating circumstances such as hormonal stress factors and gender differences. Eventually all military members, of any branch, could be potential participants. An IRB was convened and permission was obtained prior to collection of any data.

Those included initially were scrutinized further to ensure a deployment had taken place in the recent past. The member would have a lipid panel before and after a deployment, within 30 days of return, although in some cases more than 30 days had passed prior to obtaining the post-deployment lipid panel. The convenience sampling utilized was an economical method of obtaining information and a feasible population to investigate, given the world situation and the projection of long-term involvement in the Middle-East.

Study Design

A non-experimental type of study was conducted as the phenomenon has already occurred in this population. No interventions were implemented at the time of the study. Based on the results of this study, future implementations may be incorporated into the deployment process for military personnel.

Descriptive research is applicable, particularly ex post facto or correlation research to examine whether elevated cholesterol levels are at an increased prevalence after deployment vs. prior to deployment. The purpose of this type of study was to observe, describe, and document aspects of a situation as it naturally occurs. This also sometimes serves as a starting point for hypothesis generation or theory development.

Data Collection Procedures

The data collected are considered bio-physiologic measurements. The patient's medical record, specifically the lab result section, was reviewed. Information about any cholesterol levels drawn in the past 12 months was collected. The other piece of information needed and obtained from the medical record was the dates and lengths of deployment.

Reliability and Validity

Bio-physiologic measures are relatively accurate and precise, especially compared to self-reported psychological measures (Polit & Beck, 2004). They are also objective and cannot be easily distorted by patients. For example, cholesterol levels drawn reflect levels already sustained by the patient. Instrumentation of bio-physiologic measures provides valid measures of targeted variables. Lipid panels evaluate lipid levels and the equipment used to do so is standardized and tested for specific accuracy.

Another aspect to consider in the area of reliability is the fact that the lab values reflect blood drawn without any bias or prior knowledge of the member that the lipid levels would be studied. Perhaps some members would put forth more effort in the physical activity component or perhaps make more conscious dietary choices. Instead we have a glimpse of blood levels for the "average GI", as it were, no opportunity to alter patterns that they normally would follow.

Data Analysis

The first step in collecting statistical information for the study of elevated cholesterol rates in the active duty personnel was to determine the actual prevalence of the phenomenon. The number of individuals enrolled in the particular clinic being studied with elevated cholesterol levels would be divided by the total number of personnel enrolled to in this clinic. This actually was completed in the early stages of the study to first determine the prevalence of elevated cholesterol prior to deployment.

Individual values were evaluated and compared, before and after deployment, for potential negative trending. The mean of before and after levels of total cholesterol, HDL, LDL, and triglyceride levels were computed. The potential value of knowing trends of cholesterol levels would be evident for future active duty deployment operations and the services provided to those troops in deployment locations.

Protection of Human Subjects

Every effort to maintain confidentiality of the patient's pertinent information was made for the entirety of this study. As indicated earlier, a specific code of numbers and letters were used to correlate data collected from the member's to respective lab values.

Since there was no intervention being implemented and the member was already required to submit lab specimens upon the return of any and all deployments, there was no increased discomfort to the member, other than what they already endured per Air Force regulation in relation to the lab specimens. There was no control or experimental groups nor any treatment to be withdrawn or altered. In this case, the phenomenon had already occurred.

No real additional cost was incurred with the evaluation of the variables at hand. The population previously identified is primarily male. Females will not be purposefully excluded from this study, but no effort will be made to identify gender. Very little risk for injury existed related to the required health condition of members to deploy. Anyone having a serious medical condition or a condition for which they are being treated is prohibited from deploying in the first place.

CHAPTER 3

RESULTS

The purpose of this study was to determine the upward or downward trend of cholesterol levels of active duty personnel post deployment. This chapter will describe the demographics of the study sample, the statistical comparisons of the raw data, and how that data answers the research questions, which are:

1) What is the incidence of elevated cholesterol levels among military personnel prior to deployment?

2) What is the incidence of elevated cholesterol levels among military personnel upon returning from deployment?

Quantitative data were evaluated using descriptive and inferential statistics. Though the sample size was 39, some variation exists in some categories of comparisons, to include LDL sample size of 37. Depending on the level of cholesterol and triglycerides at the time the lab was drawn, LDL cannot be deduced from a specimen if triglycerides are too high. The notation "ND" was submitted into the table in those circumstances indicating "not determined".

Deployment locations are unknown at this point, but would potentially prove helpful in further studies of this subject. It is also important to establish that data was collected from medical records and concerns phenomenal data only. All laboratory

values were taken as accurate based on values obtained by standard laboratory equipment.

Demographic Description

The study participants were all active duty personnel of the male gender (n = 39). All participants ranged in age from 19 to 44 years of age with a mean age of 30.33 years of age (n = 39, SD 6.74). Criteria to be met for inclusion in the study were: deployment of 45 days or greater, no previous elevated cholesterol or any previous treatment for elevated cholesterol of any variety. The additional questions of gender variability were kept from being considered in this particular study by all participants being coincidentally male. Ethnicity was not determined by the medical records examined in this study.

Research Question #1: What is the Incidence of Elevated Cholesterol Prior to Deployment?

Medical records of 411 active duty members were reviewed to determine which members met criteria to be included in this study. From this number of records, 39 were considered to have met pre-established criteria and included in the study. Because several of the cholesterol levels were screening labs for the member's annual physical exam, it is unknown if all were "new cases" per the definition of incidence (Polit & Beck, 2004). From a prevalence standpoint, the number found to have elevated cholesterol levels would be 9 per 100 persons.

Evaluating the data, the mean of the total cholesterol was 189.92 with a standard deviation of 44.60. Individual components of cholesterol were broken down and examined on a before and after respect as well. HDL values prior to deployment had a mean value of 47.10 with a standard deviation of 11.479 (see Table 1). LDL values before deployment had a mean of 119.767, standard deviation of 39.054.

Table 1. Means Before Deployment

	Mean	SD – Deviation	N
Total	189.92	44.60	39
HDL	47.100	11.479	39
LDL	119.767	39.054	39
Member's Age	30.33	6.74	39

Research Question #2: What is the Incidence of Elevated Cholesterol Among Personnel Returning from Deployment?

Upon return from deployment the following means were noted:

Table 2. Means After Deployment

	Mean	SD – Deviation	N
Total	200.26	39.32	39
HDL	45.492	12.120	39
LDL	123.143	29.495	37
Member's Age	30.33	6.74	39

Upon return from deployment, total cholesterol levels were slightly higher with a mean of 200.26 and a standard deviation of 39.32 (see Table 2). HDL values had a mean of 45.492, standard deviation of 12.120, after deployment while LDL values had a mean of 123.143 and a standard deviation 29.495 after deployment (see Table 3).

By further breakdown of raw data, one can more closely examine individual values, both before and after deployment (see Table 6). The sequence of members is purely in order of record review and has no other significance. The youngest member to be included in

the study was 19 years of age with individual HDL and LDL values of 50 and 84 respectively, pre-deployment. After deployment this member had HDL and LDL values of 55.9 and 135.2 respectively.

The other end of the age spectrum included two individuals, both 44 years of age, one with HDL values of 45 and one with 43, pre- deployment and 56 and 32 post-deployment. LDL levels pre-deployment were 170.7 and 150.8 respectively and 138.5 and 132.1 after deployment. One note to make is the highest pre-deployment LDL was 188.4 in a 28 year old and post deployment 165.9 in a 29 year old. The lowest HDL prior to deployment was 23.8 in a 26 year old and the lowest HDL post deployment as 27.5 in a 22 year old.

To evaluate one dimension further, the following table includes all values, including the number of mg/dl either rise or fall of each of the components. Because rise in HDL is considered "healthy" and rise in LDL is "unhealthy", and vice versa for the falls in levels, color codes indicate either a negative or positive overall effect on the cholesterol values.

The number of personnel having a low (< 40 mg/dL) HDL prior to deployment was 8 (20%) while the number of personnel recording a low HDL post deployment was 15 (38%). The total number of members experiencing a drop in HDL during deployment was 21 (53%). LDL assessment revealed 21 (56%) returning from deployment with an increase in their levels, with 2 members not being included in that number related to levels being too high to be determined (LDL values are not computed in this particular laboratory when total cholesterol levels are > 400 mg/dL.)

Table 3. Individual Components Before and After Deployment With Positive and Negative Impacts Noted

Demographics		HDL			LDL		
Member	Age	Before DP	After DP	Difference	Before DP	After DP	Difference
1	35	45.5	36.7	8.8	150.5	149.8	.7
2	28	26.9	33.1	6.2	142.7	165.7	.23
3	25	43.5	42.6	.9	188.4	154	34.4
4	26	23.8	30	6.2	65.1	80.8	15.7
5	21	53	44.2	8.8	47	87.1	40.1
6	21	54	36.6	17.4	68	74.5	6.5
7	31	36	44.1	8.1	91	117.3	26.3
8	32	33	28.1	4.9	129.8	ND*	ND*
9	22	38.4	27.5	10.9	190	ND*	ND*
10	22	42.6	38.1	4.5	138.7	144.7	6
11	37	45.5	41.5	4	152.6	150.9	1.7
12	39	60	46.1	13.9	164	148.4	15.6
13	32	52.8	62.1	9.3	146.3	153.1	6.8
14	25	45	38.5	6.5	80	85.5	5.5
15	29	56	46.9	9.1	68	77.3	9.3
16	28	34.1	40.1	6	139.5	139.9	.4
17	34	63	73.1	10.1	106	141	35
18	25	41	55.9	14.9	85	116.1	31.1
19	30	44.4	38.6	5.8	137.4	128.9	8.5
20	44	45	56	11	170.7	138.5	32.2
21	44	43	32	11	150.8	132.1	18.7
22	31	37.5	39.4	1.9	100.5	104.9	4.4
23	30	37.5	38.6	1.1	173.6	168.4	5.2
24	27	37.1	45	7.9	114.4	134	19.6
25	43	73.6	69.3	4.3	150.9	131.1	19.8
26	41	36.9	38	1.1	99.3	85.6	13.7
27	27	37.6	38.4	.8	113.6	165.9	52
28	27	44.3	46.8	2.5	152.8	123.8	29
29	41	67	71.3	4.3	124	133.2	9.2
30	32	50.1	61	10.9	169.7	132.2	37.5
31	27	51	48.2	2.8	96	68.1	27.9
32	39	42	41.9	.1	137.5	165.5	28
33	30	48	30.8	17.2	74.6	98.3	23.7
34	19	50	55.9	5.5	84	135.2	51.2
35	21	53	41.3	11.7	59	77.1	18.1
36	30	70.3	57.5	12.8	67.1	86.4	19.3
37	26	48	42.4	5.6	80	42.4	37.6
38	28	67	47.2	19.8	124	120.1	3.9
39	34	59.5	69.4	9.9	138.4	121.4	17

*ND - Not determined – if triglycerides are > 400, LDL is not computed as lab is unable to separate fat particles.

Red denotes a negative effect on cholesterol component.

Green denotes a positive effect on cholesterol component.

CHAPTER 4

SUMMARY, DISCUSSION, RECOMMENDATIONS AND CONCLUSIONS

The purpose of this study was to determine if cholesterol levels were elevated after return from deployment. After noting higher than expected cholesterol levels on military personnel returning from deployment, predictions were made as to negative effects of deployment on managing cholesterol. This chapter will provide a composite look at the findings, conclusions and recommendation for nursing practice and future research.

Summary

Since days of old, coronary artery disease has long been correlated as a number one link to cardiac death (American Heart Association, www.americanheart.org). The Framingham Heart Study laid foundation for great medical advances in the way of associating lifestyle, weight control, and elevated cholesterol levels to decreased cardiovascular risks and events. The active duty military serving their country at various locations around the world continue to battle this same "silent killer", cardiovascular disease and/or the risk factors, as their civilian counterparts.

As deployed members returned stateside, a noted pattern of cholesterol changes prompted this study to evaluate a comparison of before and after deployment cholesterol levels. Specific members returning from deployment required treatment of elevated

cholesterol levels with medications according to clinical practice guidelines and DoD references.

A review of 411 medical records revealed 39 participants that fell within the preset criteria for being included in this study. These 39 participants had been deployed greater than 45 days, had serum cholesterol levels taken within 6 months prior to deployment and within 6 months after return from deployment, and had not previously had elevated cholesterol lab values. Deployment lengths varied from 45-128 days and were of unknown location for purposes of this study.

A strong positive correlation was found regarding increasing cholesterol levels in relation to increasing age, supporting innumerous studies to depict this same concept in the past. Unfortunately, the sample size greatly limited the ability to broadly generalize about any specific findings of this study. Total cholesterol levels were slightly elevated upon return from deployment, with a mean of 189.92 before deployment and of 200.26 after deployment (SD 44.60, n=39).

When cholesterol components were examined individually, approximately 50% of the participants had a decrease in their HDL values upon return from deployment (48%, n=39), while approximately 50% of the participants had an increase in HDL values (48%, n=39). One participant stayed relatively the same, (42 vs. 41.9 mg/dl). An interesting note to make is that an expected ratio of increase of HDL to decrease of LDL did not always exist. The reverse cholesterol transport is a mechanism implemented by the body in which the LDL is mediated by the HDL, and transported to the liver for "export" from the body (Hansen, 1998). In some cases noted in the study, participants had a moderate drop in LDL, while also experience a drop in HDL or a moderate elevation in LDL while

the HDL was virtually unchanged (see Appendix B). This would be an indication of varying types of dyslipidemia, including but not limited to type I and type IV.

Evaluation of LDL values indicated greater than 50% of individuals had a negative trend post deployment (58%, n=39). Two individual values of LDL were undetermined related to the high volume of lipids in the bloodstream, mainly triglycerides, and the inability to separate fat particles to differentiate type but can be assumed elevated levels compared to the before deployment values.

Discussion

In a population of young, healthy adults, such as an active duty population is said to be, one would not expect to see elevated cholesterol levels. An HDL level of 27.5 in a 22 year old is surprising, given the recommendations of leading experts supporting the thought of cholesterol worsening with age (americanheart.org). Decreases in HDL of 17 or 19 mg/dl in 28 – 30 year old males is also surprising. When patients are working diligently and striving to bring the HDL values up to recommended levels, a few points is considered a triumph over many months. How, then, can HDL values drop so drastically in a few short weeks?

Many variables must be considered when determining the "whys" and "what for" of this phenomenon. One of the variables to be considered is dietary intake. Brief comments and conversations with returning deployed members indicate a vast amount of fried foods being offered three times daily while being deployed. When one stops to consider the motivation behind this, transportation of equipment to prepare meals always includes essentials of deep-fat frying. Its quick, easy and highly transportable, some units even equipped with wheeled trailers to make evacuation readily possible.

Other aspects to consider of dietary nature include the inability of members to secure food items in their tents. Many areas of deployment in today's military are desert terrain, filled with the insects, critters, and scavengers normally found in that environment. Fruit and other fresh foods deteriorate quickly in desert heat. This presents challenges to offering a location where members working shift work or wanting to snack on healthier choices can obtain such food choices. Presently family members sending care packages are being asked to refrain from sending homemade foods/ snacks related to the rate of deterioration of the goods.

Some deployment locations are changing feasibility of accessing foods via vending machines or controlled kitchenettes that allow members admission to obtain wiser choice foods. One must still consider which foods are most likely to hold up and keep for longest periods of time, those high-processed, highly-preserved, convenience foods we are all told to indulge in sparingly. Some locations of deployment are making great efforts to offer fresh vegetables and fruits on a daily basis and are succeeding at providing attractive, healthy meal/ snack options.

Another variable to be considered with the deployment process and elevated cholesterol levels would be physical activity levels. Reports from some deployed members say that their activity levels go up in duration and intensity, many times if they have families with small children at home, related to time usually spent with loved ones at home base. With only a tent to go home to at the end of the day, physical activity is a way to beat the feelings homesickness and loneliness, and helps to fill the time off. Others report a decrease in physical activity compared to their regimen stateside. Sometimes this is due to lack of working equipment (based largely on location, fitness

center capabilities, and the amount of loose sand to be blown around the site), restrictions based on weather/ temperature conditions, or just taking any down time as "down" time.

One last variable that will be discussed in this study will be elevated cortisol levels. Cortisol is a naturally occurring hormone, also known as the stress hormone. It is secreted by the adrenal glands and involved with proper glucose metabolism, blood pressure regulation, immune function, and inflammatory response. While cortisol is an important and helpful part of the body's response to stress, higher and prolonged levels of cortisol in the bloodstream have been shown to have negative effects on several body systems. Some of these effects include blood sugar imbalances causing hyperglycemia, suppressed thyroid function, elevated blood pressure, and increased consolidation of abdominal fat, leading to metabolic conditions and cardiovascular risks.

The more pertinent population that would suffer adverse effects from elevated cortisol levels would most likely be military personnel sent in as ground troops, such as the Marines and Army, faced with extended periods without sleep or rest (which also causes variations in cortisol levels) and adrenaline producing encounters known as "fight or flight" episodes. However, even the stress of deployment or being away from home during holidays or emergencies can create an elevated level of cortisol. The effect of this phenomena on this particular study is unknown.

Simple questions to ask that may play a role in phenomenon at hand are:
Is the participant a smoker? (Smoking has been shown to contribute to the dyslipidemia process and is considered a risk factor in and of it self.) Is there a family history of cardiovascular disease or hyperlipidemia? (Study after study has shown the familial tendencies of cardiovascular disease and cholesterol control.) Did the participant partake

of alcohol within 72 hours of the blood being drawn? (Alcohol consumption has a direct effect on cholesterol levels, specifically triglycerides.)

In the study at hand, there was no interaction with the member, only a medical record review was completed. The simple questions above may help to answer some questions of why the unexpected levels in a population such as this.

Recommendations for Further Study

To effectively consider the variables mentioned above, additional steps would need to be taken in order to determine the true effect, either negative or positive, of deployment on cholesterol levels. All branches of the military could potentially be included in future studies and all branches of the military could likewise, benefit from any significant findings.

Closer evaluation of dietary intake could be completed using a survey process. A point system to assign numerical value to specific answers would allow an analysis of the data for comparison studies. Included on that survey would be inquiry into the questions posed earlier: smoking, family history, and alcohol intake. To go a step further, asking members who may be willing to complete food diaries during times of deployment would potentially shed some light on the positive and negative impacts noted on HDL and LDL.

Physical activity would also need to be defined and similar surveys could be completed with duration, frequency and intensity of work outs documented. If members were deployed in locations where the equipment was an issue, more creative ways of exercising may be an outcome at the end of the study. Other issues that may come to light with physical activity evaluation of deployed members may find correlation regarding age, marital status, and type of activity performed. A survey with numerical

values given to specific answers would provide the best source of data to be manipulated. Several tools have been used in other studies to date.

Finally, the evaluation of elevated cortisol levels should at least be considered in any future study. It is difficult to determine to what extent cortisol affects actual cholesterol levels. A tool would need to be utilized that would describe each individual's perception of stress and what their stress level is at any given time. As each person is an individual, what might be considered stress to them, may not be considered stress by someone else. For example, an experienced war veteran who has seen many battles up close and personal will have a wildly varied perception of their stress as compared to that of an 18 year old, first term soldier who is seeing their first war battle.

For future studies, an ideal situation would be to evaluate lab values of soldiers as they are deployed, for whatever length of time they are activated, and immediately upon their return. This would most likely provide a larger sample size and enable generalized deductions to be made. Cholesterol levels and cortisol levels could be drawn during the out/in processing at each end of deployment and a more accurate picture of the true effect of deployment could be deducted.

Recommendations for Nursing Practice

The theoretical framework for this study was Nola Pender's Health Promotion model. As nursing professionals, military nurses have a window of opportunity to provide the seeds of thought for making changes and promoting health prevention vs. treatment for disease. As military members, health benefits extend a lifetime, at least in present day. What good fortune would the military have to actually begin the health promotion process in the youngest of its members! The monetary savings would be

astronomical as well as the issues of quality of life, frustration levels and limitations that would ultimately affect the military members.

If only it were that simple! As the Health Promotion Model points out, motivation for health behavior is a driving force behind the outcomes of such behaviors. It is stimulated by a combination of cognitions and other personal and environmental factors. If cholesterol imbalances and cardiovascular diseases continue to be portrayed as conditions of the aging, and problems of advancing age, little motivation exists for an individual in their 20's to make drastic changes in their lifestyle.

The 5-dimensional classification system proposed Pender includes affect, attitudes, activity, aspirations, and accomplishments. Included under the 5 main categories, but not limited to the following, are: positive life patterns, meaningful work, invigorating play, self-actualization, social contributions, optimism, and serenity. The deployment process and military life can be thought of in connection with each of those areas. Self actualization, social contributions and meaningful work could potentially have daily connotations.

Once the member's concept and perception of health is understood by the nursing professional, direction for behavior changing motivations and patterns will become clearer. Health promotion and prevention begin with a framework of knowing what decisions are in the control of the individual and what decisions are not. And by providing rational and motivation for those decisions, modification will most likely occur.

Closely related to patient success and lipid management is nursing involvement. A number of nurse case management models are described in the literature and compare

quite favorably to other models of care in terms of outcomes (Mundinger, Kane, Lenz, Totten, Tsai, Cleary, Friedewald, Siu, Shelanski, 2000; Runyan, 1975; (Bargardi, Starling, 1999). The strong emphasis on lifestyle modification is brought to the home, community, worksite, and hospitals and clinics with oversight provided by nurses. All case management models describe strong patient counseling and follow-up monitoring components, and while military installations often provide disease management for active disease at home stations, many are lost to follow-up and those concluded to be at risk only are not aggressively counseled.

Health and Wellness Centers throughout the military are making contributions through programs offered, but again most individuals taking part in these programs have been identified as "needing" the service and have been mandated to participate. There is much more that could be done, for both those being identified as having elevated cholesterol levels and those at risk of developing the problem.

Recommendations for Military Education

Although some deployment locations are showing improvements dietary choices, much can be done to enable active duty members to maximize their choices, considering options available to them. Currently, educational classes through most Health and Wellness Centers (HAWC) are available to the select individuals who have trouble passing a physical fitness test or meeting weight standards. For those who do not fall into those categories, most may be unaware of such classes or the potential benefits of these educational opportunities.

For the past several years, nursing has been about health promotion and prevention as much as taking care of active disease in patients. Health promotion begins

by equipping members with knowledge that will affect choices in their lives. Providing a knowledge base in nutrition, i.e. calorie counting, label reading and interpreting, and basic physiology, would perhaps be a starting point. With all the "mandatory training" in today's military, one would hate to add additional topics to cover. But the long term effects could mean savings for military medical health for years to come.

The other potential advantage the military population may have is to identify those with increased cholesterol levels at earlier ages. Some movement toward screening at earlier ages is being seen in areas of healthcare, but many insurance companies and payment sources are not progressing with the same momentum. Military members, by having mandatory annual physical exams, could be compelled to have an annual lipid panel done as well. Currently, the cholesterol tests are dictated by regulation to begin at age 25 and then repeated every 5 years. One suggestion would be to begin the process at 18 – 20 years of age and repeat annually, becoming a part of the actual exam. Members with elevated cholesterol would be identified earlier and any treatment could begin earlier as well. We begin taking action against coronary artery disease and cardiovascular risks in optimal time intervals vs. years after the process has begun. This could actually begin another "arm" of cholesterol research and active duty members.

Conclusions

The world in which we live will continue to grow, evolve and erupt as a result of the many cultures and peoples that live in it. The need for a military population is as evident today as it was in the very beginnings of this country in its struggle for freedom. The difference is today's military is agile and mobile, spanning itself across the globe at a

moment's notice. Because members are deployed, should health promotion and prevention be postponed or forgotten until the member is at home base?

The Framingham Heart Study delved into cardiovascular health and the many risk factors associated with it. As in the days after the World Wars, many of the health problems to be experienced by our men in uniform were unknown until a much later date. This study proposed to evaluate the effects of deployment on just one aspect of health, cholesterol values.

While not statistically significant, interpretations indicate a clinical significance. When viewed independently, several cholesterol values were negatively impacted by deployment. Equal numbers of HDL levels decreased and increased, while a greater number of LDL levels actually increased with the sample studied. Means of pre and post deployment values varied slightly, with no huge statistically significant values.

One main unfortunate aspect of this study was the limited sample size. Further research is needed on larger samples of participants in order to draw scientifically sound conclusions of effects of deployment on cholesterol levels. The benefits of determining how deployment can be made a more positive experience may have a large impact in several areas, including future health of military members, stretching the tax dollar on the those members, and providing a more positive environment in which they deploy.

APPENDIX A

Tool for Gathering Cholesterol/ Deployment Data

Cholesterol Levels Per Medical Record Review

1. Does the member have a history of elevated cholesterol? Yes no

2. Is member on medication for hyperlipidemia? Yes no

3. When was cholesterol last checked? Date _____

4. What was last cholesterol level? Ttl _____ Tri _____ HDL ____ LDL ____

5. What was the next most recent cholesterol level drawn? Date _____

   Ttl _____ Tri _____ HDL _____ LDL _____

6. When was member last deployed? Date _____

   Length of deployment? _____ 60 days _____ 90 days _____ 120 days

7. What is patient's age? _____

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